

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554**

In the Matter of)	
)	
Facilitating Opportunities for Flexible, Efficient, and)	ET Docket No. 03-108
Reliable Spectrum Use Employing Cognitive Radio)	
Technologies)	
)	
Authorization and Use of Software Defined Radios)	ER Docket No. 00-47
)	(Terminated)

COMMENTS OF ERICSSON INC

To: The Commission

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SUMMARY

Ericsson Inc (“Ericsson”) hereby submits comments in response to the Federal Communications Commission’s (“FCC” or “Commission”) *Notice of Proposed Rulemaking and Order* (“*NPRM*”), released December 30, 2003,¹ seeking comment on revision of certain rules in Parts 2, 15 and 90 to facilitate opportunities for flexible, efficient, and reliable spectrum use employing cognitive radio technologies without creating harmful interference.

Ericsson believes that cognitive radio technologies can play a significant role in the more efficient use of spectrum. Nonetheless, Ericsson is concerned that the *NPRM* prejudices the viability of various technologies which are unproven and may leave networks vulnerable. More specifically:

- Ericsson is encouraged by the possibilities that cognitive radio technologies offer. However, the Commission should step back at this stage and allow the marketplace to sort out which of the cognitive radio technologies may become commercially viable. Adopting rules that promote a specific cognitive technology at this time may unintentionally favor that technology over another, hindering full deployment of competing technologies.
- The operation of certain technologies for cognitive use expressed in the *NPRM* are inconsistent with existing commercial mobile radio system use and may skew continued development of these technologies which help to increase coverage range, provide consistent transmission reliability, and enhance data transmission rates.
- The proposed rule changes may steer public safety entities into reliance on unproven technologies when proven technologies are available to accomplish the stated goals;

¹ *Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies, Authorization and Use of Software Defined Radios*, (ET Docket No. 03-108, ER Docket No. 00-47 (Terminated)), Notice of Proposed Rulemaking and Order, 18 FCC Rcd 26,859.

- The proposed rule changes may upset the delicate balance that exists among unlicensed communications operating under Part 15.
 - The proposed revisions to Part 15 to allow higher power operation on certain unlicensed devices may create a greater likelihood of harmful interference, including out-of-band emissions;
 - At this time, cognitive radios have not matured sufficiently to allow high-powered operation without creating additional sources of interference. A more efficient and effective means of achieving this goal is to revise the existing rules to increase the EIRP output power levels of licensed carriers' facilities.

Ericsson recommends that the Commission delay action on the proposals set forth in the *NPRM* to allow the marketplace to continue working, allowing development of cognitive radio technology uninfluenced by regulation.

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Ericsson Inc (“Ericsson”) hereby submits comments in response to the Federal Communications Commission’s (“FCC” or “Commission”) *Notice of Proposed Rulemaking and Order* (“*NPRM*”), released December 30, 2003,² seeking comment on how it might “facilitate opportunities for flexible, efficient, and reliable spectrum use employing cognitive radio technologies.”³ Generally, the Commission seeks comment on whether to revise rules in Parts 2, 15, and 90 to promote the development of cognitive radio without creating harmful interference. The *NPRM* asked for comment on a number of issues including, *inter alia*, what benefits cognitive radio technology may offer for spectrum management, whether it should permit increased power limits for certain unlicensed devices in rural areas if they incorporate cognitive radio technology to manage spectrum use, and whether cognitive radio technology will enable public safety licensees to lease spectrum efficiently to third parties while also enhancing interoperability between public safety communications systems.

Ericsson is the largest supplier of mobile systems in the world and has a presence in more than 140 countries. It supports all major standards for wireless communication. The world’s ten

² *Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies, Authorization and Use of Software Defined Radios*, (ET Docket No. 03-108, ER Docket No. 00-47 (Terminated)), Notice of Proposed Rulemaking and Order, 18 FCC Rcd 26,859 (2003) (“*NPRM*”).

³ *NPRM* at ¶ 7, 18 FCC Rcd 26,862.

largest mobile operators are among Ericsson's customers and approximately 40 percent of all mobile calls are made through Ericsson's systems.⁴

Ericsson supports the Commission's goal of enhancing spectrum efficiency and improving interoperability, particularly in the public safety spectrum. Ericsson agrees that cognitive radio technologies can play a significant role in the more efficient use of spectrum. Nonetheless, Ericsson is concerned that the *NPRM* prejudices the viability of various technologies which are unproven and may leave networks vulnerable. More specifically:

- Ericsson is encouraged by the possibilities that cognitive radio technologies offer. However, the Commission should step back at this stage and allow the marketplace to sort out which of the cognitive radio technologies may become commercially viable. Adopting rules that promote a specific cognitive technology at this time may unintentionally favor that technology over another, hindering full deployment of competing technologies.
- The operation of certain technologies for cognitive use expressed in the *NPRM* are inconsistent with existing commercial mobile radio system use and may skew continued development of these technologies which help to increase coverage range, provide consistent transmission reliability, and enhance data transmission rates.
- The proposed rule changes may steer public safety entities into reliance on unproven technologies when proven technologies are available to accomplish the stated goals;
- The proposed rule changes may upset the delicate balance that exists among unlicensed communications operating under Part 15.

⁴ See <http://www.ericsson.com/about/>.

- The proposed revisions to Part 15 to allow higher power operation on certain unlicensed devices may create a greater likelihood of harmful interference, including out-of-band emissions;
- At this time, cognitive radios have not matured sufficiently to allow high-powered operation without creating additional sources of interference. A more efficient and effective means of achieving this goal is to revise the existing rules to increase the EIRP output power levels of licensed carriers' facilities.

The Commission should define the characteristics of what is unused spectrum before adopting rules specifying how cognitive radios should determine whether spectrum is unused and is therefore available for cognitive radio use. Ericsson is concerned that the *NPRM* proposes to change the Commission's rules without fully considering the impact of the changes on non-cognitive radio operations. For these reasons, Ericsson urges the Commission to reevaluate its effort to facilitate cognitive radio technologies and allow the marketplace to continue working, uninfluenced by regulation.

DISCUSSION

I. Cognitive Radio Technologies

The FCC envisions that cognitive radio technology will improve spectrum management by allowing a radio to negotiate cooperatively with other transmitters to enable more efficient sharing of spectrum.⁵ In order to accomplish such a negotiation, each participating radio must communicate and share meaningful and accurate information about spectrum usage. Using the information received, the cognitive radio would locate and use unused spectrum in the time,

⁵ *NPRM* at ¶ 20, 18 FCC Rcd 26,866.

space, code and frequency domain resulting in more “intense, more efficient use of the spectrum while avoiding interference to other users.”⁶

The FCC assessed various capabilities that could be incorporated into cognitive radios, and asked for comment on how cognitive radio capabilities might function together to achieve spectrum access, efficiency, and interference mitigation.⁷ For example, the FCC discussed whether dynamic frequency selection (“DFS”) could be used as a monitoring mechanism to detect signals dynamically from other radio frequency systems and avoid co-channel operation with those systems.⁸ DFS has been used successfully in wireless local area networks (“LAN”) or WiFi systems. In WiFi, DFS has two purposes: 1) to avoid frequencies used by radio determination and 2) to ensure that neighboring access points (“AP”) do not use the same frequency, or more generally, to ensure an automatic frequency planning among APs. Since the APs are stationary, DFS can measure signals transmitted from those points. In a mobile environment, however, DFS has limited applicability since DFS is used to detect existing signals from fixed devices, but is not effective at detecting signals in a mobile environment

The FCC also contemplated that transmit power controls (“TPC”) may work in conjunction with DFS to allow the output power to be adjusted depending on changing conditions, as determined by the DFS device. TPC is generally incorporated in state-of-the-art radio systems not only for power savings to enable increased battery run times, but to achieve the desired signal quality for all radio connections sharing a given radio frequency in the same or neighboring cells. For example, in Code Division Multiple Access (“CDMA”) systems, the transmit power of mobile stations is always controlled to the minimum level required just to sustain the radio link with the desired data rate and reliability. Limiting the power of individual

⁶ *Id.*

⁷ *NPRM at ¶ 23*, 18 FCC Rcd 26,867-26,868.

⁸ *NPRM at ¶ 24*, 18 FCC Rcd 26,868.

or all transmitters below the self controlled levels will sacrifice the coverage range for those transmitters, reduce the transmission reliability, or decrease the data rate available for those transmitters.

Although the DFS/TPC combination may successfully monitor and control output power in some fixed environments, the combination is not suitable for a mobile environment. DFS cannot adequately monitor the environment when the cognitive device travels. Even if it could, TPC's response may reduce the output power of the cognitive device to a point where the communication connection is lost.

In the *NPRM*, the Commission also expressed further interest in the development of software defined radios ("SDR") and cognitive radios.⁹ The Commission described the potential of SDR and cognitive radio to "vastly improve the efficiency of spectrum usage at a time when the demand for wireless communications services is rapidly increasing."¹⁰ The FCC also noted the Defense Department's interest in developing cognitive radio technology. Through the NeXt Generation ("XG") program, the Defense Advanced Research Projects Agency ("DARPA") is working to develop technology using adaptive techniques that will allow multiple users to share common spectrum while avoiding conflicts in time, frequency code, and other signal characteristics.¹¹ DARPA hopes to increase spectrum usage by a factor of ten through this program.¹²

As the FCC stated in the *NPRM*, each of the SDR, cognitive radio, and XG technologies shows great promise and provides Ericsson with many exciting possibilities, but none is fully developed or commercially available. WiFi and CDMA networks used by commercial mobile

⁹ *NPRM* at ¶ 12, 18 FCC Rcd 26,863-26,864.

¹⁰ *NPRM* at ¶ 12, 18 FCC Rcd 26,863.

¹¹ *NPRM* at ¶ 16, 18 FCC Rcd 26,865.

¹² *Id.*

radio service (“CMRS”) networks employ degrees of intelligence in processing traffic on their networks.¹³ These cognitive-like applications came to fruition through the functioning of a competitive marketplace. If the underlying technology is viable, SDR, cognitive radio, and XG applications may achieve their fullest potential through the operation of the marketplace without the service specific rules proposed in the *NPRM*.

In order to reach commercial viability in a mobile setting, cognitive radio technology must achieve a number of milestones including, but not limited to, favorable market conditions, technology advancements, economic viability and acceptance in the market. For example, while it may be possible to develop real-time processing capabilities associated with some of these technology concepts while still conforming to the constraints of a small handset, the power consumed by the processing may require support from a power source too large and too heavy to make it practicable.

Clearly, the marketplace will have to address these and many other challenges as cognitive radio technologies reach full commercial deployment. We are encouraged by the possibilities cognitive radio technologies may offer when they are available. However, the Commission should step back at this stage and allow the marketplace to sort out which of the cognitive radio technologies may become commercially viable. Adopting rules that promote a specific technology at this time may unintentionally favor that technology over another, hindering full deployment of competing technologies. To promote the fullest development of multiple cognitive technologies, the Commission should not intervene prematurely.

¹³ *NPRM* at ¶ 11, 18 FCC Rcd 26,863.

II. Public Safety Licensees

A. Interruptible Public Safety Spectrum Leasing

In its *NPRM*, the FCC notes that interruptible spectrum leasing may be particularly useful for public safety spectrum.¹⁴ Public safety communications, some of which are time-critical, are characterized by very high peak-to-average use ratios with low average use.¹⁵ However, in emergency situations, public safety organizations must have access to spectrum. Therefore, the Commission seeks comment on how cognitive technologies may allow leased use of public safety spectrum, what steps it should take to facilitate public safety licensees' use of cognitive technology for spectrum they lease to others, and what approaches it should take regarding use of cognitive radio to enhance leased use of public safety spectrum.¹⁶

While more efficient usage of public safety spectrum is a commendable goal, ensuring reversion of spectrum use to the public safety licensee/lessor may prove to be a barrier to implementing secondary markets in public safety spectrum. The Commission can attain public safety spectrum efficiency through far more reliable, cost effective, and less complex means. Specifically, Ericsson proposes that the Commission encourage public safety spectrum efficiency by supporting public safety entities' use of commercially available systems¹⁷ for those functions and applications that do not require dedicated access to spectrum. These systems can either be

¹⁴ *NPRM* at ¶51, 18 FCC Rcd 26,878-26,879.

¹⁵ *Id.* at ¶52, 18 FCC Rcd 26,878, citing *Spectrum Policy Task Force Report*, ET Docket No. 02-135 (November 15, 2002), at 43; Bykowski, Mark, M. and Marcus, Michael J., "Facilitating Spectrum Management Reform via Callable/Interruptible Spectrum," 2002 Telecommunications Policy Research Conference (September 2002) at 15, <http://intel.si.umich.edu/tprc/papers/2002/147/Spectrum_MgmtReform.pdf>; FCC Cognitive Radio Workshop, "Cognitive Radio Technologies in the Public Safety & Governmental Arenas," Presentation by Michael Marcus, Sc. D., Office of Engineering and Technology, Federal Communications Commission, at 2, 12 (May 19, 2003).

¹⁶ *NPRM* at ¶53, 18 FCC Rcd 26,879.

¹⁷ National Communication System ("NCS"), the entity with responsibility for the day-to-day administration of Priority Access Service ("PAS") for public safety personnel, asserts that priority access to cellular spectrum is essential in conducting response and recovery efforts of NSEP personnel at Federal, State, and local levels. *The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010*, (WT Docket NO. 96-86), Second Report and Order, 15 FCC Rcd 16,720, 16,723 (2000).

deployed in existing public safety bands or services can be provided on a cost basis from commercial systems or through managed networks.

Public safety entities have traditionally used dedicated systems to handle much of their individual communications needs. Consequently, these systems are incompatible with other systems from other agencies and jurisdictions. Today, the overall demands on public safety agencies are very different from what they were just a few years ago. Agencies need coordinated operations with efficient sharing of information. They also need access to local, state and federal databases to retrieve and send still images, full-motion video, mugshots, fingerprints, maps, and geographical, architectural, and infrastructure information. Public safety agencies can satisfy these demands best through common information and communications systems. These common systems offer a high degree of flexibility for integration and information sharing with the digital information databases.

While, arguably, technological developments may make creating a cognitive system for leasing spectrum from multiple public safety entities possible, it would create high transaction costs for spectrum whose availability is uncertain, at best. Such a costly and complicated system would create high transaction costs for spectrum whose availability is uncertain at best. Also, if a lessee uses public safety spectrum and does not return it immediately when a public safety entity needs it for an emergency, the lessee may risk liability for any injury arising from the public safety licensee/lessor's failure to respond appropriately.¹⁸ Given all these concerns, public safety can use spectrum more efficiently by using services on a cost basis from public mobile networks or implementing commercially available systems in public safety spectrum, or a combination of

¹⁸ Congress has enacted the Wireless Communications and Public Safety Act of 1999 which provides wireless carriers with the same protection from liability under Federal and State law as wireline carriers, especially with regard to emergency calls. It may also be necessary to cover liability which may arise from leasing public safety spectrum. 15 FCC Rcd 16,731.

these approaches. These approaches allow public safety entities to capitalize on the tremendous build-out of commercial mobile networks throughout the world and provide an improved platform for upgrading and enhancing their communications systems cost-effectively.

The Commission has long sought more efficient use of public safety spectrum. In comments before the Computer and Telecommunications Board of the National Academy of Science, John Muleta, Chief of the Commission's Wireless Telecommunications Bureau specifically challenged the commercial community to leverage its infrastructure for the benefit of public safety. He proposed that public safety entities reexamine the traditional self-provisioning paradigm under which they operate.¹⁹ As Mr. Muleta recognized, commercial networks are especially appropriate for public safety use because they offer, among other things, nationwide and improved in-building coverage, position location, encryption, priority access, group communications and complete functionality for voice, messaging, data and imaging.²⁰ In fact, many private corporations provide international support for disaster recovery and emergency response using relay stations or additional complete base stations. These stations can for example be mounted in a fire truck or be a complete mobile radio base station mounted in a container taken to the scene either by land, air or sea. These containers are currently used in many operations and contain satellite or microwave backhaul for quick transmission connection. Thus, commercial networks provide the public safety sector a new option when considering how to upgrade existing communications systems. In the future, 3G capabilities will enhance

¹⁹ John Muleta, Chief, Wireless Telecommunications Bureau, Federal Communications Commission, Presentation to National Academy of Science, Computer and Telecommunications Board, (February 12, 2004).

²⁰ The Public Safety Wireless Advisory Committee ("PSWAC") Final Report also addressed the role of commercial services in supporting public safety communications. PSWAC recommended facilitating "[t]he use of commercial services and private contracts . . . , provided the essential requirements for coverage, priority access and system restoration, security, and reliability are met." 15 FCC Rcd 16,723.

commercial networks even further, by providing higher data rates, allowing introduction of new services such as fast data transmission and video telephony.

New proprietary communications systems are increasingly expensive to develop. The Commission must require extensive study when considering revising its rules to facilitate development of new systems. Commercial systems that benefit from mass-market use can provide suitable services for many public safety applications in an efficient way compared to dedicated systems in dedicated spectrum and a limited market. Consequently, public safety entities' use of commercial systems will increase its efficient use of spectrum, while also satisfying many of their technical requirements.²¹ Further, as technology continues to develop, the abilities of commercial mobile networks will expand even further and public safety will benefit.

Ericsson supports the Commission's goal of increasing use and efficiency of public safety spectrum. However, promoting interruptible spectrum leasing aided by cognitive devices is not the most efficient or cost-effective method to achieve this goal. The commercial mobile industry, in particular, has been extremely successful in developing new technologies that maximize spectrum efficiency while providing services to millions of consumers at any moment in time.²² Remarkably, CMRS innovations allow networks to be 76 times more efficient than

²¹ For example, commercial mobile networks can provide public safety entities with many services and options including compact handsets, high quality voice service, email, enhanced nationwide coverage and capacity, in-building coverage, international roaming, data communication, wireless internet browsing at speeds at or above dial-up, text messaging ("SMS"), automated information alerts, enhanced 911 ("E911") service, the ability to take, store, exchange, and print photographs, position location, security (including, among others, authentication and encryption), priority access, select group communications, fast call set-up, tailor-made terminals, direct-mode terminals, expanded radio coverage, dispatch and command centers, WiFi interworking, push-to-talk, priority access, and more.

²² CMRS carriers in the United States have achieved dramatic increases in spectrum efficiency in large part because of the spectrum shortages with which they have been faced. Specifically, while Japan, Germany, and the United Kingdom have 300 MHz, 305 MHz, and 364 MHz of commercial wireless spectrum respectively, the United States has approximately 190 MHz of licensed commercial wireless spectrum. Clearly, licensees have market incentives to deploy state-of-the-art technology and are already doing so far more efficiently than any set of additional regulations could prescribe. See Comments of the Cellular Telecommunications & Internet Association, *In the Matter of United*

they were just ten years ago through use of spread spectrum, frequency hopping, digital modulation, and smart antennas.²³

Ericsson believes that commercial mobile networks can meet most of the current and future demands of public safety entities.²⁴ Global products built on open standards²⁵ provide inherent interoperability and will allow public safety entities to enjoy full access to new products and applications supported by a large market of suppliers. This approach may serve the public safety community better than other options rather than implementing concepts that introduce risk to their mission or require them to wait for services to develop that are supported by a much smaller market. Moreover, commercial systems are expected to be far more economical to operate and substantially more cost-effective to enhance than new cognitive systems for leasing spectrum. At the same time, commercial systems offer the spectrum efficiency and many technical abilities that public safety entities require. This alternative solution will also provide more certainty for all users rather than the leased public safety spectrum approach, where lessees may not know when public safety licensees will preempt further communications for an

States Spectrum Management Policy for the 21st Century, Docket No. 040127027-4027-01, Department of Commerce, National Telecommunications and Information Administration (fil. Mar. 18, 2004) at p. 7.

²³ *Id.* at p. 12.

²⁴ In general, Federal, State and local government public safety organizations are increasingly using CMRS systems. Certain Federal Government entities stress that there is a growing need to use commercial services rather than dedicated private systems for their wireless communications needs, due to the potential for lower costs of commercial services. Additionally, the PSWAC Final Report recommended that the Commission facilitate the use of commercial systems for public safety personnel. The City of Long Beach, California comments that even though it has a private radio system, it has no plans to cease using commercial wireless services. Moreover, it has become commonplace in natural disasters and other emergencies for commercial wireless providers to donate both handsets and airtime to public safety personnel for use during the emergency. 15 FCC Rcd 16,725.

²⁵ One key accomplishment achieved is a joint effort between CMRS and NCS to establish wireless priority access. The goal of the Wireless Priority Service (“WPS”) is to provide an end-to-end nationwide wireless priority communications capability to key national security and emergency preparedness (“NS/EP”) personnel during natural or man-made disasters or emergencies that cause congestion or network outages in the Public Switched Network (“PSN”). WPS Fact sheet <http://63.121.95.245/documents/WPS%20Fact%20Sheet.pdf>

unknown duration. For these reasons, Ericsson strongly urges the Commission to encourage public safety entities to use commercial systems to achieve public safety goals.²⁶

B. Public Safety Interoperability

The FCC seeks comment on whether cognitive technology can facilitate interoperability between systems, including federal government public safety and non-federal public safety systems.²⁷ Specifically, the Commission asks what rule changes are necessary to allow and encourage interoperability and how cognitive technology can support wireless E911 services.²⁸ Ericsson believes that a public safety system based in whole or in part on commercial networks will provide a cost efficient solution for systems and terminals, ensuring both interoperability²⁹ and advanced functionality.

Ericsson supports the Commission's goal of encouraging interoperability. The FCC illustrated the critical importance of interoperability in relation to the September 11, 2001 Pentagon attack.³⁰ It observed that Arlington County Fire personnel could have communicated with firemen from other jurisdictions and used handsets from other stations if the communications systems had been interoperable.³¹

²⁶ Under its charter, the Network Reliability and Interoperability Council ("NRIC") (VII) has been charged with providing recommendations to improve emergency communications networks and related technologies and facilitate the provision of emergency services through new technologies. NRIC will have to present a report recommending specific architecture properties that emergency communications networks are to provide by the year 2010 along with a generic architecture that meets these specifications. The report should identify the additional text and data information emergency networks should be able to receive. This additional information may include text information (e.g., Instant messaging, e-mail, Short Message Service), pictures (e.g., from cellular phones), paging information, information from concierge services, Intelligent Vehicle Systems, and automatic crash notification systems. The NRIC has recommended a generic emergency communications network architecture(s) that will enable Public Safety Answering Points ("PSAPs") to receive the recommended information. Commercial systems are naturally suited to provide most of these services today and in many cases already provide the additional text and data information services public safety entities may need.

²⁷ *NPRM* at ¶ 76, 18 FCC Rcd 26,888.

²⁸ *Id.*, 18 FCC Rcd 26,887.

²⁹ For example, in the Oklahoma City bombing incident, one of the first messages broadcast to the local public was to stop using wireless phones so that emergency and rescue workers could communicate. 15 FCC Rcd 16,726.

³⁰ *NPRM* at 76, 18 FCC Rcd 26,888.

³¹ While the dedicated systems may not be interoperable, the commercial networks allowed full communication among the various jurisdictions. According to NCS, wireless technology played an important role in making

At the same time, achieving true interoperability requires more than just harmonized spectrum and cognitive devices capable of operating across several bands and possibly several protocols. Interoperability is a broad goal that requires substantial groundwork based on planned operations management. Planned operations management poses a complex array of challenges including jurisdictional and cross-disciplinary communications. If one of these three components, harmonized spectrum, devices, or management, is weak, the others cannot compensate. Often overlooked, planned operations management requires public safety entities to agree on many key issues including talkgroup designations, operations leaders, frequencies, chain-of-command, and resources that they will use, before an emergency event has taken place. Moreover, poorly planned cross-use may allow personnel from different jurisdictions to simply roam onto the system of another jurisdiction and use its resources. This uncoordinated action may disrupt ongoing mission-critical activities. Public safety entities must address these factors as part of achieving full interoperability. If public safety entities try to rely on cognitive technologies to address these fundamental concerns, they will stress resources in one area at the expense of the others.

For these reasons, Ericsson urges the Commission to step back from its proposal to promote cognitive radio technology as a means of interoperability. Rather, Ericsson supports public safety entities' use of proven commercial systems to achieve reliable spectrum efficiency and cost efficiency while gaining access to new, desired services which interoperate across common commercial platforms.

communications for emergency workers in New York and Washington, DC. In a March 8th, 2004 letter to the Honorable Thomas Ridge, Secretary of the U.S. Department of Homeland Security, the Cellular Telecommunications and Internet Association ("CTIA") cited "the pivotal role that wireless communications services played in the aftermath to the terrorist attacks of September 11, 2001 demonstrated that wireless systems provided critical communications services to the public as well as to Public Safety and Federal agencies. For several years, many of our member companies have been working with Department of Homeland Security (DHS) to develop voluntary, workable and efficient emergency wireless communications systems for key government personnel."

III. Rural Markets and Unlicensed Devices

The *NPRM* sought comment on a proposal to allow unlicensed devices to operate at higher power levels within certain bands in order to improve access to spectrum in limited use (“rural”) areas.³² The *NPRM* proposed to bridge larger separations between transmitters and receivers by increasing Radio Frequency (“RF”) power levels for unlicensed operations. The increased RF power levels would exceed the specified Part 15 limits, cited as a limitation to adequate signal coverage, especially in rural areas.

While Ericsson supports the Commission’s overall goal of improving services to rural areas, it does not believe that allowing unlicensed devices equipped with cognitive technology to operate at higher power levels in rural areas is the appropriate means to achieve this goal. Unlicensed devices must be regulated with clear rules regarding access etiquette and other operational and technical considerations in order to allow equal access to the spectrum without creating additional sources of harmful interference and preventing disruption to any co- or adjacent bandwidth authorized carriers’ services.³³ At this time, cognitive radios have not matured sufficiently to allow high-powered operation without creating additional sources of interference. Therefore, increasing output power in unlicensed bands would likely create additional congestion and introduce additional sources of interference to co- or adjacent band operators.

A more efficient and effective means of achieving this goal is to revise the existing rules to increase the equivalent isotropic radiated power (“EIRP”) output power levels of licensed

³² See, *NPRM* at ¶¶ 33-47, 18 FCC Rcd 26,871-26,876.

³³ Mike Musgrove, *Here, There, WiFi Anywhere*, The Washington Post April 25, 2004 at F01. Mr. Musgrove related a story where to WiFi signals were in such gridlock, that residents formed an “ad hoc neighborhood spectrum allocation committee” to coordinate channel allocations. Spectrum congestion is not just isolated to suburban areas, a number of other wireless devices compete for spectrum like microwaves, cordless telephones and Bluetooth equipped devices that are or already appear in a large percentage of homes. A copy of the article is attached as Attachment 1 to these comments.

carriers' facilities. Permitting licensed carriers to operate at higher power levels will allow them to provide services to rural areas at lower costs with more certainty and under a controlled interference situation. This approach will serve rural customers' needs for improved coverage and better services, in a more reliable, sustainable and cost-effective manner. Also, this approach will not increase the risk of harmful interference.

A. Higher Power Operation for Unlicensed Operations Should Not be Permitted in Any Frequency Bands Under Part 15 of the Rules

The Commission proposes to add a new rule permitting unlicensed cognitive radio devices operating in the industrial, scientific, and medical ("ISM") bands on the frequencies included in Sections 15.247 and 15.249 to operate at higher power levels in any area that has limited spectrum use (*i.e.*, rural areas), provided the devices have capabilities to determine whether they are in an area with limited spectrum use.³⁴ Specifically, the Commission proposes to increase transmitter power of these two bands to up to 6 times (approximately 8 dB) higher than the current limits.³⁵ The Commission also seeks comment on whether to increase power levels of devices operating in other bands under Part 15 of the rules.³⁶

Ericsson does not agree with increasing RF power levels of unlicensed devices operating in any bands under Part 15 of the rules. The Commission developed the existing Part 15 regulatory scheme to allow an unlicensed shared environment while minimizing interference. The Commission's proposal may upset that delicate balance by facilitating cognitive technologies before any is implemented. In fact, no conclusive studies are available that show non-interference to systems that were designed to specified conditions under existing Part 15 of the rules, including those operating in the ISM bands. Furthermore, the ability of any cognitive

³⁴ See, *id.* at ¶ 37, 18 FCC Rcd 26,872.

³⁵ See, *id.* at ¶ 38, 18 FCC Rcd 26,872.

³⁶ See, *id.* at ¶ 41, 18 FCC Rcd 26,874.

radio to determine whether an area has limited spectrum use is, at best, uncertain. Technology will need to advance significantly and complex networks will need to be developed before a monitoring device will be able to determine spectrum occupancy reliably. Substantial investment in research and development must precede any authorization to operate unlicensed cognitive radios at the proposed higher output power.

Further, even assuming the technological capabilities exist, the location of any given transmitter will be unknown at any particular point in time, given the mobility of users and objects in the immediate environment. Determining spectrum use in a dynamic RF environment poses serious problems as noted in Ericsson's comments on the Commission's interference temperature model.³⁷ As Ericsson said, the ever-changing nature of the mobile environment and the significant difficulties in quantifying the interference temperature environment in real-time, limit the ability to identify, prevent, and curtail interference to the licensee. In the same way, the mobile environment will also limit the ability of a transmitter to detect, in real-time through cognitive radio technology, whether spectrum is sufficiently "unused."

The Commission's proposal would allow a transmitter power increase of up to 6 times (approximately 8 dB) higher than the current limits in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands under Section 15.247 of the rules, and in the 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24.0-24.25 GHz bands under Section 15.249 of the rule. The proposed increase would result in interference not only within these bands, which to the most part are already subject to interference, but likely also in adjacent bands since out-of-band

³⁷ See Ericsson's Comments to *Notice of Inquiry and Notice of Proposed Rulemaking, In the Matter of Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, (ET Docket No. 03-237) Notice of Proposed Rule Making 18 FCC Rcd 25,309 (fil. Apr. 22, 2004).

emissions levels are based on in-band output RF power. Clearly, studies need to be performed to determine the interference risks more conclusively.

Since increasing RF power as proposed in the *NPRM* will increase the risk of interference to (1) licensed operators; (2) unlicensed devices; and (3) licensed operators in adjacent bands, Ericsson strongly urges the Commission to consider Ericsson's alternative proposal which will not pose the same risks.

B. The Commission Should not Eliminate or Relax Spread Spectrum Sharing Requirements

Ericsson does not believe that the Commission should relax current requirements, for example, in the spread spectrum rules (channel spacings, channel bandwidths, power spectral density, or number of hopping channels) which were established to facilitate spectrum sharing with licensed services and between unlicensed operations.³⁸ Until cognitive radio technologies are fully developed and applied, it is premature to consider relaxing important rules ensuring that the proposed unlicensed operations are reliable and will not create interference for licensed operators, and that different unlicensed devices may share spectrum in a clearly defined manner.

C. The Commission Should Better Define "Unused Spectrum" Monitoring Before Revising its Rules

The Commission proposes to define "unused spectrum" as "spectrum with a measured aggregate noise plus interference power no greater than 30 dB above the calculated thermal noise floor within a measurement bandwidth of 1.25 MHz, which is the same value specified for unlicensed PCS devices."³⁹ It also proposes that a device must be able to sense across the entire authorized band of operation to determine spectrum occupancy before commencing transmissions at higher power.

³⁸ See, *NPRM* at ¶¶ 37, 40, 18 FCC Rcd 26,872-26,874.

³⁹ See, *id.* at ¶ 44, 18 FCC Rcd 26,875.

Specifically, the Commission seeks comment on (1) the specific percentage of spectrum that must be vacant for a band to be considered “empty enough” to allow higher power transmission; (2) how long a device must sense a band of spectrum to determine if it is unused before the device can transmit at higher power; (3) the type of receive antenna that should be used in measuring spectrum occupancy; (4) whether the proposed monitoring threshold is reasonable; and (5) how wide a frequency band should be monitored to make this determination. The Commission also seeks comment on the capabilities a device needs in order to determine when spectrum is sufficiently empty, whether the required capabilities are achievable now or in the near future, and whether they could be economically incorporated into devices.

Definitely, studies need to be performed before these questions may be answered. The Commission should gather more information about the viability of the proposed technology, the impact on other usage, as well as possible impact between different cognitive radio technologies and systems before the Commission considers revising its rules.

D. RF Safety Limits Should be Maintained

The Commission seeks comment on any problems that unlicensed devices may experience in meeting the RF safety limits if they operate at higher power levels.⁴⁰ Under the Commission’s proposal, unlicensed devices operating at higher RF power levels would be required to comply with current RF safety limits, which could limit users’ abilities to increase its power on the return path. The Commission suggests that use of properly designed sectorized receive antennas, coupled with their inherent gain, at the central site, could overcome these limitations.

Ericsson recommends that the Commission ensure that unlicensed devices continue to meet the RF safety limits if permitted to operate at higher output power levels.

⁴⁰ See, *id.* at ¶ 45, 18 FCC Rcd 26,876.

E. Higher Power Devices Would Block Lower Power Devices

The Commission recognizes that allowing some devices in a band to operate with higher RF power could block the use of lower power devices, resulting in a situation where certain devices will not be able to operate.⁴¹ Consequently, the Commission seeks comment on whether high RF power devices should be required to re-sense spectrum use at periodic intervals to determine whether other users are attempting to transmit, or whether high power devices should shut down at certain intervals to allow an opportunity for other devices to access spectrum.

As indicated above, higher RF power operation by unlicensed devices will require more advanced technology to determine spectrum occupancy. This capability may not be achievable due to the dynamic RF nature of a mobile environment.

F. Ericsson's Proposed Alternative

Ericsson believes customers in rural areas may be better served by simply revising existing rules as opposed to creating new rules based on technology that is still under development and whose application to permit high powered unlicensed operation will likely introduce additional interference. In particular, changing the existing rules to allow relaxed EIRP output power limits for licensed carriers will encourage more efficient and reliable service to customers in rural areas.

Relaxing restrictions of the output power limit will benefit the public and improve service in rural areas. With the ability to use higher output power, operators will be able to improve coverage outdoors, indoors, and in vehicles.⁴² Also, with higher output power limits, licensed carriers will be able to cover a greater area without construction of as many additional base

⁴¹ See, *id.* at ¶ 46, 18 FCC Rcd 26,876.

⁴² With today's radio base stations in traditional 3-sector configurations (e.g., tower mounted low-noise receiver amplifiers and 4-branch receiver antenna diversity), technology exists making it possible to balance the reverse link with higher output power in the forward link, but this may exceed current power limits. Adoption of Ericsson's alternative proposal will achieve the Commission's goals without creating harmful interference.

stations. These benefits will be particularly significant in higher cost rural areas where carriers will be able to extend services and provide them more cost effectively to rural customers.⁴³ Implementing this alternative spectrum management proposal will eliminate the need to increase unlicensed devices' power levels and therefore reduce the risk of unpredictable service and increased interference in rural areas.

IV. SDR and Cognitive Radio Equipment Authorization Rule Changes

The Commission asked for comment on a proposal to streamline its SDR rules that currently require that a copy of certain devices' radio software be supplied to the Commission, to clarify when devices must be certified under the software defined radio rules.

Although the Commission adopted the SDR rules over two years ago, to date no manufacturer has filed an application to certify a device under the Commissions new SDR rules. The Commission, therefore, seeks comment on whether it should change its rules to make them mandatory.⁴⁴ Ericsson opposes any requirement that manufacturers/importers declare certain equipment as SDRs. Current rules provide adequate safeguards against unauthorized modifications to SDRs. A mandatory SDR filing requirement for some devices could be a disincentive to the deployment of SDRs and burden the industry by inhibiting robust development of an efficient manufacturing technique.

⁴³ As stated by the Commission, "[i]ncreasing the range of radio systems is one means of making it more economical to provide spectrum-based radio services in rural areas by potentially lowering infrastructure costs. One way to increase the range of radio systems is by increasing power levels." See, *In the Matter of Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services*, 2000 Biennial Regulatory Review *Spectrum Aggregation Limits For Commercial Mobile Radio Services, Increasing Flexibility to Promote Access to and the Efficient and Intensive Use of Spectrum and the Widespread Deployment of Wireless Services, and to Facilitate Capital Formation*, Notice of Proposed Rule Making (WT Docket Nos. 02-381, 01-14, 03-202) 18 FCC Rcd 20,802, 20,829-20,830 (2003). The Commission took this approach for the Cellular Radiotelephone Service in 1986 when it increased the maximum power level for rural base stations from 100 Watts to 500 Watts, and again in 1988 when it extended this flexibility to all cellular base stations, subject to coordination zone along market boundaries. See *id.*

⁴⁴ *NPRM* at ¶84, 18 FCC Rcd 26,890-26,891.

V. Conclusion

Ericsson believes that cognitive radio technologies do and will in the future provide additional degrees of spectrum efficiency and access; however, significant research is necessary to determine what specific role a cognitive radio technology can potentially play without the risk of creating additional interference and unreliability. Ericsson's comments address the proposal to promote a secondary market using public safety spectrum and its potential risk to public safety networks in critical operations. Additionally, the use of cognitive technologies to allow unlicensed use in licensed bands or high-powered use in unlicensed bands could allow additional interference and introduce uncertainty in the band.

Overall, Ericsson submits that the proposals in the *NPRM* to rely on cognitive technology in the manners proposed for spectrum efficiency are premature and alternative proposals should be considered to achieve the desired goals. Ericsson cautions that the *NPRM* proposes to change the Commission's rules without fully considering the impact of the changes on non-cognitive radio operations. In addition, progress is being made in the marketplace in the development and application of cognitive technologies. Applying additional rules and regulations could delay its continued progress.

For these reasons, Ericsson submits these comments, urging the Commission to embrace the marketplace and allow it to continue forward with the development of cognitive radio technologies.

Respectfully submitted this 3rd day of May, 2004.

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